Instruction Manual
LIQ-MAN-385
Rev. E
April 2017

Rosemount™ 385

pH/ORP Sensors

EMERSON™

Essential Instructions

Read this page before proceeding!

Emerson designs, manufactures and tests its products to meet many national and international standards. Because these sensors are sophisticated technical products, you MUST properly install, use, and maintain them to ensure they continue to operate within their normal specifications. The following instructions MUST be adhered to and integrated into your safety program when installing, using, and maintaining Rosemount products. Failure to follow the proper instructions may cause any one of the following situations to occur: loss of life; personal injury; property damage; damage to this sensor; and warranty invalidation.

- Read all instructions prior to installing, operating, and servicing the product.
- If you do not understand any of the instructions, contact your Emerson representative for clarification.
- Follow all warnings, cautions, and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation, and maintenance of the product.
- Install your equipment as specified in the Installation Instructions of the appropriate Instruction Manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Emerson. Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, and VOID YOUR WARRANTY. Third-party substitutions may result in fire, electrical hazards, or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

The information contained in this document is subject to change without notice.

⚠ DANGER

Hazardous Area Installation

This sensor is not Intrinsically Safe. or Explosion Proof. Installations near flammable liquids or in hazardous area locations must be carefully evaluated by qualified on site safety personnel.

To secure and maintain an intrinsically safe installation, an appropriate transmitter/safety barrier/sensor combi nation must be used. The installation system must be in accordance with the governing approval agency (FM, CSA or BASEEFA/CENELEC) hazardous area classification requirements. Consult your transmitter instruc tion manual for details.

Proper installation, operation and servicing of this sensor in a Hazardous Area Instal lation is entirely the responsibility of the user.

⚠ CAUTION

Sensor/Process Application Compatibility

The wetted sensor materials may not be compatible with process composition and operating conditions. Application compatibility is entirely the responsibility of the user.

⚠ WARNING

Retractable sensors must not be inserted nor retracted when process pressures are in excess of 64 psig (542kPa)

About This Document

This manual contains instructions for installation and operation of the Rosemount 385 pH/ORP Sensors.

The following list provides concerning all revisions of this document.

Rev. Level	Date	Notes
A	08/98	This is the initial release of the product manual. The manual has been reformatted to reflect the Emerson documentation style and updated to reflect any changes in the product offering.
B	07/02	Updated drawing on page 5.
C	05/03	Updated dimension drawing
D	09/09	Update last page with division name and new DNV logo 2008.
E	04/17	Reformatted to reflect the latest Emerson documentation style and updated the ordering information, EC Declaration of conformity, FM Installation drawing, and Accessories.

Contents

Section 1: Description and Specifications

- Retractable sensor can be easily removed and replaced under pressure without process shutdown.
- Chemically rugged Tefzel body with titanium tube provides maximum resistance and is completely sealed to eliminate sensor leakage.
- Long-life, tripple junction reference electrode provides longer service life in applications where poisoning ions are present.
- Integral preamplifier provides noise free long distance transmission of the high impedance pH signal.

1.1 Features and Applications

The Rosemount 385 pH/ORP Sensor is designed to meet a wide variety of industrial applications. It has been specially designed for applications where the process cannot be shut down and a separate sample stream is difficult or impossible to provide. The Model 385's body is constructed of standard Titanium tube and Tefzel allowing the sensor to be used in especially harsh applications such as bleach lines in paper mills.

The Rosemount 385 pH/ORP Sensor is designed for use with a standard 1-1/2 in. ball valve. This makes it ideal for replacing or updating any manufacturer's existing retractable pH/ORP sensor without process shut-down. Initial installations can even be accomplished without process shut-down by hot tapping a 1-1/2 in. ball valve at the desired point of measurement.

Sensor removal is accomplished by retracting the sensor until it reaches the built-in retraction stop collar (no cables or chains are required for retraction). The ball valve may then be closed, and the sensor removed. The entire process is accomplished with almost no loss of process fluid and without depressurizing the line. Once the sensor is removed from the ball valve it can easily be buffer checked or its disposable sensor tube replaced.

The Rosemount 385 pH sensor comes standard with a triple junction gel filled reference cell. The peripheral ceramic liquid junction around the base of the glass electrode assures maximum working life even in solutions containing ammonia, chlorine and other poisoning ions.

The plug-in style solid state preamplifier is housed in a junction box as an integral part of the sensor.

1.2 Performance and Specifications

Table 1-1: Rosemount 385 sensor specifications

pH Range	
GPLR 0-13pH, High pH 0-14 pH	
Maximum Pressure at Retraction and Insertion	
64 psig (542 kPa abs)	
Maximum Process Pressure and Temperature	
100 psig (790 kPa abs) at 100 °C	
Temperature Compensation	
0 to 100 °C (212 °F)	
Wetted Materials	
Tefzel, titanium, Viton, Teflon, a 316 stainless steel compression fitting with EPDM, glass, and ceramic	
Repeatability	
± 0.05 pH	
Interconnecting Cable	
P/N 9200000	
Electrical Classification	
General Purpose	
Process Connections	
FNPT ball valve	1-1/2 in.
MNPT with only male connector	1 in.
Weight/Shipping	
With Ball Valve	10 lb/15 lb
Without Ball Valve	5 lb/10 lb (2.25 kg/4.5 kg)

1.3 Ordering Information

Table 1-2: Rosemount 385 ph/ORP sensor ordering information

Model	Sensor type
385	pH/ORP Sensor
Tube Material	
02	Titanium
Sensor Compatibility/TC	
04	No TC - For Rosemount 1181 ORP, 1060, 1023
06	Pt-100 - For Rosemount 1054/1054A/B ORP
07	3k TC - For Rosemount 1181 pH, 1050, 1003
08	Pt-100 - For Rosemount 1054/1054A/B pH, 2054 pH, and 2081
Combination Electrode	
10	pH - GPLR Glass
11	High pH Glass
12	ORP
Preamplifier	
51	Integral Preamplifier for use with Rosemount 1003, 1023
52	No Preamplifier for use with Rosemount 1181 pH/ORP, 1050/1060, and 1003/1023
53	No Preamplifier for use with Rosemount 1054, 1054A, 1054B, 2054, and 2081
Typical Model Number: 385-02-06-10-54	

Note: *Recommended interconnecting cable from sensor to transmitter is P/N 9200000*

1.4 Product Certifications

Please see online certificates for further details.

IECEx

Sensors with no preamp – Ex ia IIC T4 Ga (-20°C ≤ Ta ≤ +60°C)

Per standards IEC60079-0 : 2011, IEC 60079-11 : 2011

ATEX

Sensors with no preamp – Ⓔx II 1 G Ex ia IIC T4 Ga (-20 ˚C ≤ Ta ≤ +60 ˚C)

Per standards EN 60079-0: 2012+A11:2013, EN 60079-11:2012

FM

See online FM Certificate of Compliance for applicable sensor options:

Intrinsically Safe for use in Class I, II, and III, Division 1, Groups A, B, C, D, E, F, and G; Temperature Class T6 Ta = -20 °C to +60 °C

Intrinsically Safe for use in Class I, Zone 0, AEx ia IIC T6 Ta = -20 °C to +60 °C

Nonincendive for use in Class I, Division 2, Groups A, B, C, and D; Temperature Class T6 Ta = -20 °C to +60 °C

Suitable for use in Class II and III, Division 2, Groups E, F, and G; Temperature Class T6 Ta = -20 °C to +60 °C Hazardous (Classified) Locations

IS/I,II,III/1/ABCDEFG/T6 Ta = 60°C - 1400332; Entity; I/0/AEx ia IIC/T6 Ta = 60 °C - 1400332; Entity; NI/I/2/ABCD/T6 Ta = 60 °C; S/II,III/2/EFG/T6 Ta = 60 °C

Per standards 3600:1998, 3610:2010, 3611:2004, 3810:2005

CSA

See online CSA Certificate of Compliance for applicable sensor options:

Intrinsically Safe and Non-Incendive::

Class I, Division 1, Groups ABCD; Class II, Division 1, Groups EFG; Class III; Class I, Division 2, Groups ABCD; Ex ia IIC; T6; Ambient temperature rating -20 °C to +60 °C: (Simple Apparatus)

Per standards C22.2 No. 142 – M1987, C22.2 No 157 – M1992, CAN/CSA E60079-0:07, CAN/CSA E60079-11:02, UL 50:11th Ed., UL 508:17th Ed., UL 913: 7th Ed., UL 60079-0: 2005, UL 60079-11: 2002

Section 2: Installation

2.1 Unpacking and Inspection

Inspect the outside of the carton for any damage. If damage is detected, contact the carrier immediately. Inspect the instrument and hardware. Make sure all items in the packing list are present and in good condition. Notify the factory if any part is missing.

The Rosemount 385 is shipped in two parts. The measuring electrode and sensor housing with junction box and the preamplifier (or 15 ft coaxial cable for use with a remote preamplifier). The 1-1/2 in. ball valve, 1 x 1-1/2 in. reducing coupling and 1-1/2 in. close nipple are available as an option (P/N 23240-00 in 316 stainless steel or P/N 23240-01 in carbon steel).

NOTICE

Save the original packing cartons and materials as most carriers require proof of damage due to mishandling, etc. Also, if it is necessary to return the instrument to the factory, you must pack the instrument in the same manner as it was received. Refer to Section 6.0 for instructions.

⚠ WARNING

Glass electrode must be wetted at all times (in storage and in line) to maximize sensor life.

2.2 Mechanical Installation

The Rosemount 385 Sensor may be installed through a 1-1/2 in. weldalet or in a pipe tee or “Y”, as shown in Figure 2-1, when used with a ball valve. Insert the end of the sensor to a depth sufficient to ensure that the glass bulb is continuously wetted by the process fluid. The Model 385 can also be inserted directly into process without a ball valve using its 1 in. MNPT process fitting (Figure 2-2). Allow sufficient room for the safe maintenance of the sensor. per sonnel should have room for stable footing during retrac tion and re-inser tion of the sensor. The sensor must be mounted within 80 degrees of vertical with the tip pointed downward, thus keeping air bubbles out of the pH sensitive glass bulb. Bubbles settled in the glass bulb disrupt the electrical continuity between the pH sensitive glass and the silver/silver chloride measuring element.

2.2.1 Installing the Sensor

1. If the sensor is inserted directly into the process without a ball valve, go to Step 2. Carefully remove the rubber boot which protects the glass electrode and keeps the liquid junction wet. Make sure the lubricated O-ring is in place in the groove inside the male connector body (A). With the male connector on the sensor, screw the male connector body (A) into the process ball valve. Insert the sensor into the ball valve assembly until it gently contacts the closed valve. (The molded electrode guard will protect the glass bulb from breakage.)

2. Thread the male connector body tightly into the ball valve assembly or process connection. DO NOT tighten the hex nut on the male connector body; this would crimp the ferrule on the sensor tube prematurely.

3. Pull back hard on the sensor assembly, as if trying to remove the sensor, to be certain that the sensor cannot come free from the valve assembly and the male connector. The built-in retraction stop collar at the end of the sensor will butt against the shoulder of the male connector.

4. When the sensor assembly is properly secured by the ball valve assembly, the valve may be opened and the sensor positioned into the process at the desired depth and orientation.

⚠ CAUTION

The sensor must be captured by the valve assembly and the male connector so that it cannot be blown free by process pressure if mishandled during insertion or retraction.

5. Tighten the hex nut of the male connector to tightly secure the sensor in place during process conditions. When tightened, the Teflon ferrule inside the hex nut clamps the sensor tube. (See Figure 4-3).

⚠ CAUTION

Over tightening the hex nut may damage the ferrule.

NOTICE

A stainless steel ferrule is available if the TEFLON ferrule does not inadequately grip. When using the metallic ferrule, care must be taken to avoid over tightening and damaging the sensor tube. If the male connector leaks during insertion or retraction, replace the O-ring in the male connector.

Figure 2-1: Typical Mounting Details

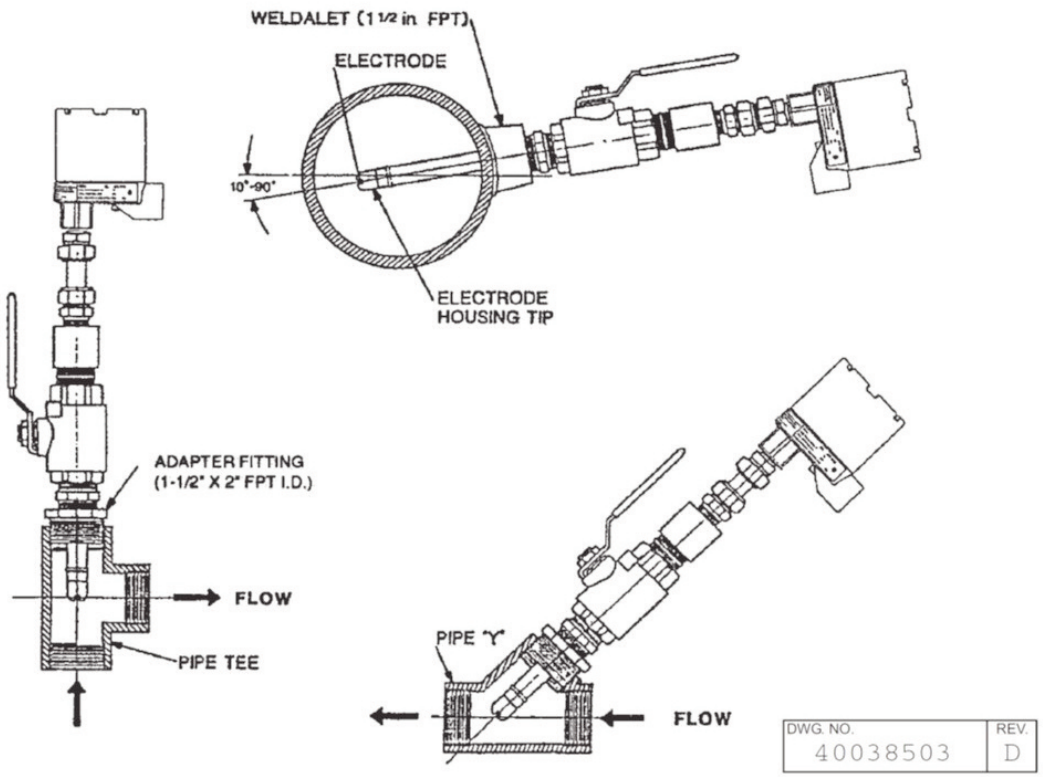
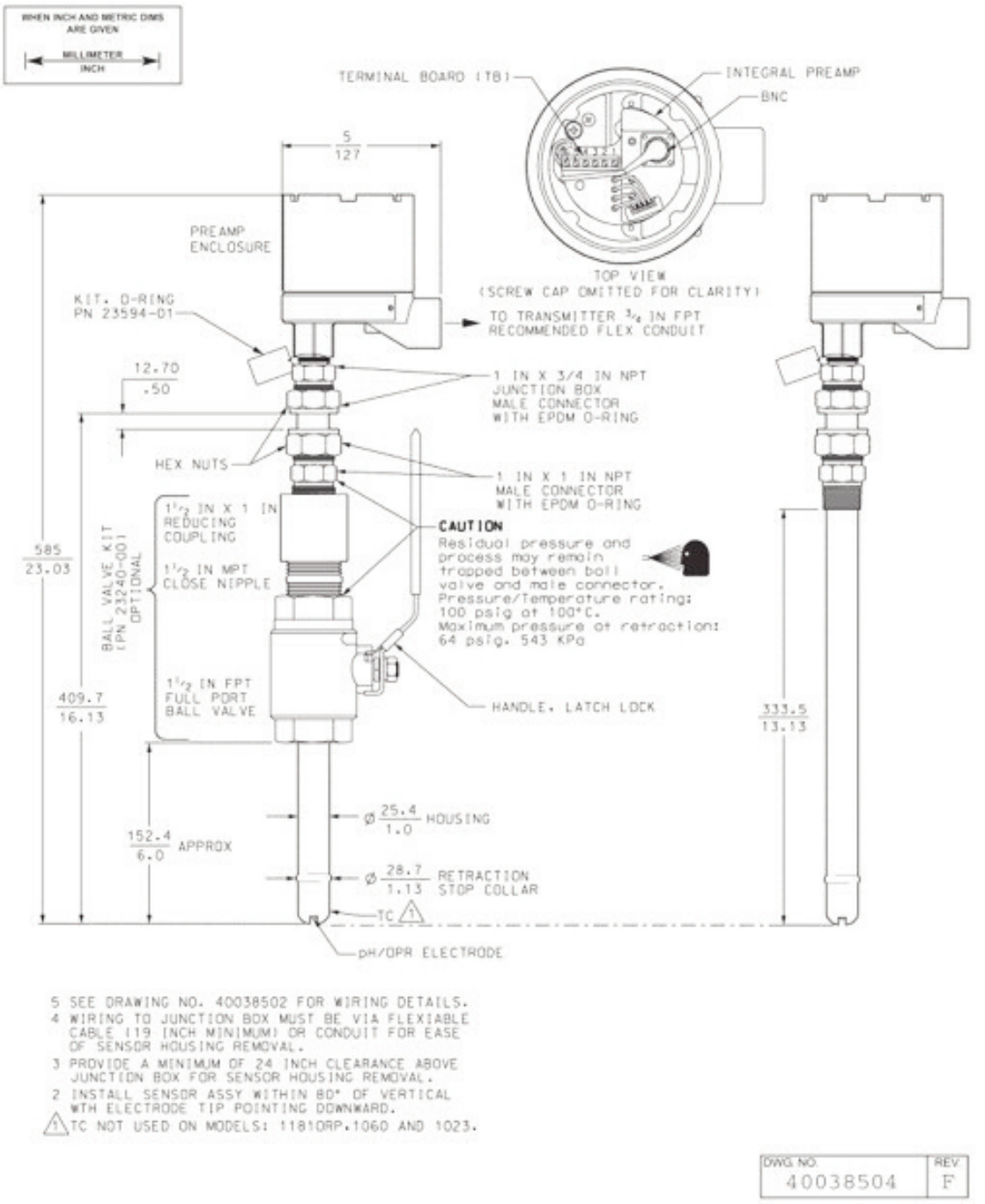


Figure 2-2: Dimensional Drawing



2.3 Electrical Installation

Make electrical connections as shown on Figures 2-3 using the following guidelines:

1. Pay particular attention to the analyzer or transmitter model number when following details on the wiring diagrams to ensure that the connections are made to the proper terminals.

2. Use a high quality four conductor shielded instrument cable such as Belden 8722. This is available from Rosemount as Part Number 9200000.

3. Maximum sensor to analyzer distance is: (Integral preamplifier in sensor) 1054, 1054A pH/ORP, 1054B pH/ORP and 2054 pH - 1000 ft 1181 pH/ORP, 1050A/1060A,1003/1023 - 1 mile with standard cable.

4. Signal cable should be run in a dedicated conduit and should be kept away from AC power lines.

For additional wiring information on this product, including sensor combinations not shown here, please refer to the Liquid Transmitter Wiring Diagrams.

Figure 2-3: Wiring Details for Options 51

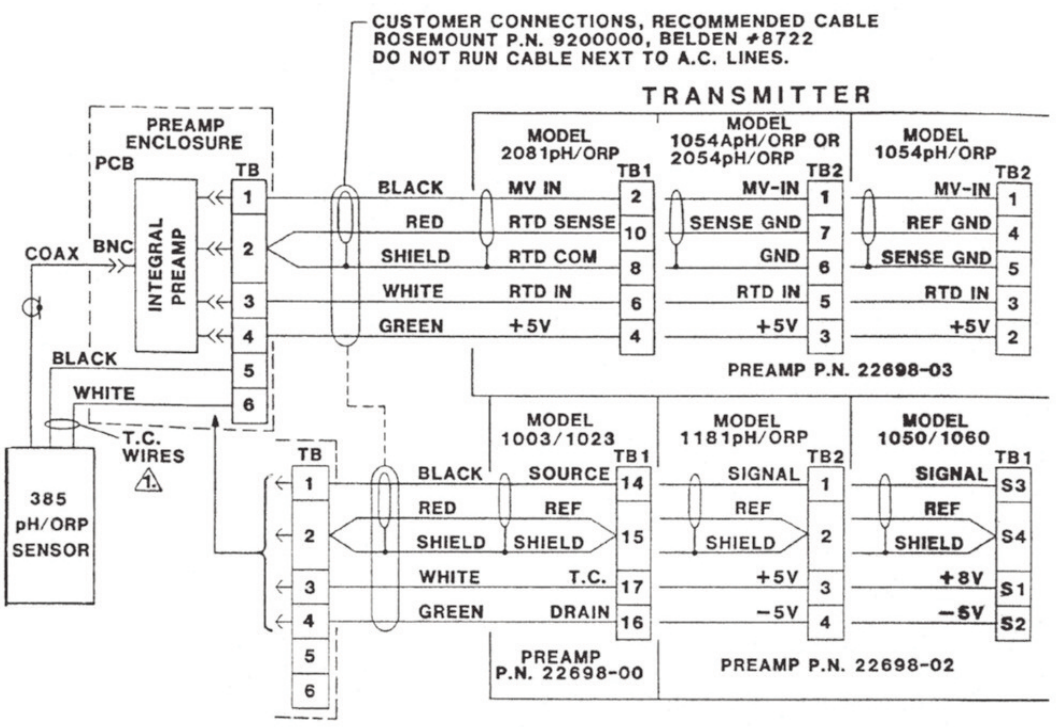
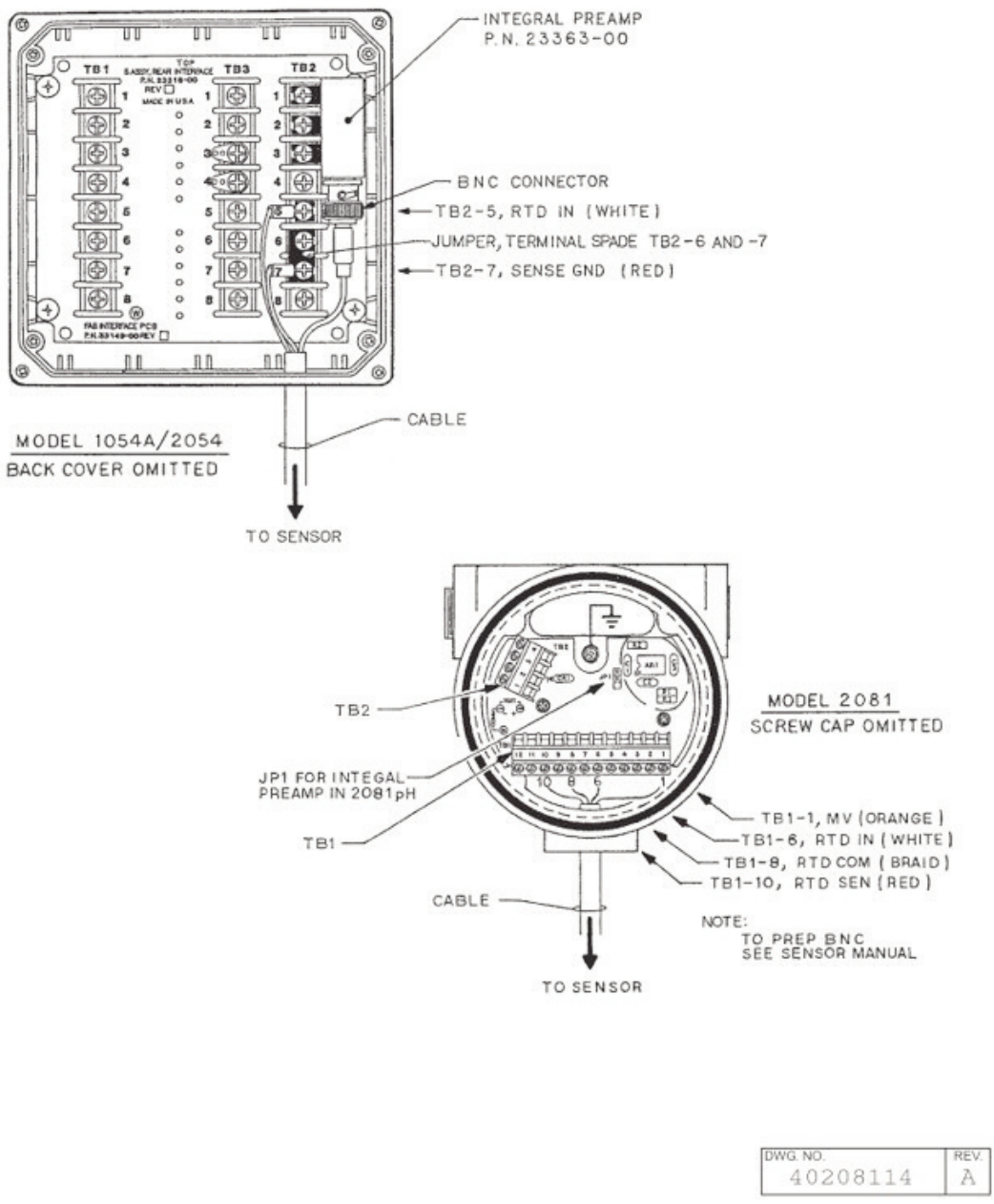


Figure 2-4: Wiring Details for Option 53



Section 3: Startup and Calibration

3.1 Startup

In most cases, the sensor can simply be installed as shipped and readings with an accuracy of ± 0.6 pH may be obtained. To obtain greater accuracy or to verify proper operation, the sensor must be calibrated as a loop with its compatible analyzer or transmitter. Please refer to the or the transmitter's respective instruction manuals for proper calibration procedures.

3.2 Calibration Using Buffer Solutions or Grab Samples

The sensor-transmitter loop may be calibrated by submersing the sensor in a buffer solution (standard solutions of known pH values) or in a process grab sample whose pH value may be checked by a calibrated laboratory or portable pH meter.

3.3 Rosemount 385 ORP Calibration

Most industrial applications have a number of ORP reactions occurring in sequence or simultaneously. There can be several components that are oxidized or reduced by the reagents that are used. Theoretically, the ORP potential is absolute because it is the result of the oxidation-reduction equilibrium. However, the actual measured potential is dependent on many factors, including the condition of the surface of the ORP platinum electrode. Therefore, the sensor should be allowed 1-2 hours to become "conditioned" to the stream when first set-up or after being cleaned.

3.3.1 ORP Calibration

1. Make a temporary electrical connection between the sensor and the instrument.

2. Obtain a standard solution of saturated quinhydrone (4 pH or 7 pH). This can be made quite simply by adding a few crystals of quinhydrone to either pH 4 or pH 7 buffer. Quin hydrone is only slightly soluble, so only a few crystals will be required. The resulting solution is yellow in color. (Refer to Section 4.4.1 for an alternate ORP standard solution).

3. Immerse the sensor in the standard solution. Allow 1-2 minutes for the ORP sensor to stabilize.

4. Adjust the standardize control of the transmitter to the solution value shown in Table 3-1. The resulting potentials, measured with a clean platinum electrode and saturated KCl/AgCl reference electrode, should be within ±20 millivolts of the value shown in Table 3-1. Solution temperature must be noted to insure accurate interpretation of results. The ORP value of saturated quinhydrone solution is not stable over long periods of time; therefore, these standards should be made up fresh each time they are used.

5. Remove the sensor from the buffer, rinse and install in the process.

Table 3-1: ORP of Saturated Quinhydrone Solution

	pH 4			pH 7		
Temperature °C	20	25	30	20	25	30
Millivolt Potential	268	264	260	94	87	80

Section 4: Maintenance

4.1 Sensor Removal

Remove the sensor from the ball valve as follows:

1. Be certain system pressure at the sensor is below 64 psig (542 kPa) before proceeding with the retraction. It is also recommended that the personnel wear a faceshield and have a stable footing.

⚠ WARNING

System pressure may cause the sensor to blow out with great force unless care is taken during removal. Make sure the following steps are adhered to.

2. Push in on the sensor using the top of the J-box and slowly loosen the hex nut (B) of the process end male connector (A). (Refer to Figure 4-2).

3. When the hex nut is loose enough, slowly ease the sensor back completely until the retraction stop collar is reached.

⚠ CAUTION

Failure to withdraw the sensor completely may result in damage to the sensor when the valve is closed.

4. Close the ball valve slowly. If there is resistance it may be hitting the sensor. Double check that the sensor has been retracted to the retraction stop collar.

⚠ WARNING

Before removing the sensor from the ball valve, be absolutely certain that the ball valve is fully closed. Leakage from the male connector threads may indicate that the male connector is still under pressure. Leakage through a partially open valve could be hazardous.

5. The Male Connector Body (A) may now be completely unthreaded from the reducing coupling and the sensor removed for servicing.

Note: With the ball valve fully closed, some residual process fluid may leak from the connectors MNPT pipe threads. This leakage is normal and to be expected.

4.2 Sensor Maintenance

4.2.1 Electrode Cleaning

If the electrode is coated or dirty, clean as follows:

1. Remove the sensor from process as previously instructed in Section 4.1.

2. Wipe the glass bulb with a soft, clean, lint free cloth or tissue. If this does not remove the dirt or coating, go to Step 3. (Detergents clean oil and grease; and acids remove scale.)

3. Wash the glass bulb in a strong detergent solution and rinse it in clean water. If this does not clean the glass bulb, go to Step 4.

⚠ CAUTION

The solution used in the following step is an acid and should be handled with care. Follow the directions of the acid manufacturer. Wear the proper protective equipment. Do not let the solution come in contact with skin or clothing. If contact with the skin is made, immediately rinse with clean water.

4. Wash the glass bulb in a dilute 5% hydrochloric acid solution and rinse with clean water. Soaking the sensor overnight in the acid solution can improve cleaning action.

Replace the sensor if it cannot be cleaned.

4.2.2 Automatic Temperature Compensator

The temperature compensator element is temperature sensitive and can be checked with an ohmmeter. Resistance increases with temperature.

The 3K element will read 3000 ohms ±1% at 25°C (77°F) and a Pt-100 will read 110 ohms. Resistance varies with temperature for a 3K and Pt-100 element and can be determined according to Table 6-2 or the following formula:

$$RT=R0\ [l+R1\ (T-20)]$$

Where RT = Resistance

T = Temperature in °C

Refer to Table 4-1 for R0 and R1 values

Table 4-1: Temperature vs Resistance of Automatic Temperature Compensator Elements

Temperature °C	Resistance (Ohms) ±1%	
	3K	PT-100
0	2670	100.0
10	2802	103.8
20	2934	107.7
25	3000	109.6
30	3066	111.5
40	3198	115.4
50	3330	119.2
60	3462	123.1
70	3594	126.9
80	3726	130.8
90	3858	134.6
100	3990	138.5

Table 4-2: R_0 and R_1 Values for Temperature Compensation Elements

Temperature Element	R_0	R_1
3K	2934	0.0045
PT-100	107.7	0.00385

4.2.3 Preamplifier Check (For Rosemount 1003/1023, 1050/1060 Transmitters)

To determine if the preamplifier is operable, proceed as follows:

1. Using a BNC Shorting Cap (Refer to Figure 4-1) or a paper clip, short the preamplifier connection. See Table 3-2 for input voltages.
2. With the STANDARDIZATION knob on the transmitter in a nearly vertical position, the meter should be able to be made to read 7.0 pH and zero (0) millivolts for ORP.
3. If the meter/display can not be made to read 7.0 pH or zero (0) millivolts, replace the old pream plifier with a new one and perform the check again.

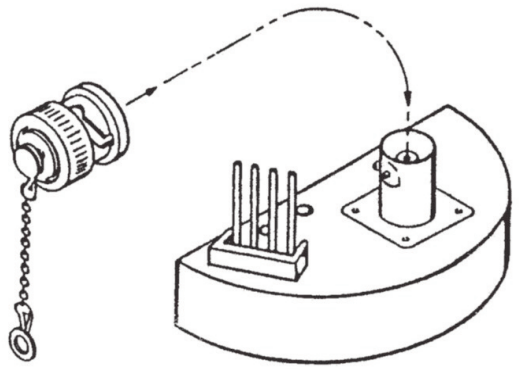
Note: For other Rosemount transmitters, refer to their respective instruction manuals for input checks, etc.

4.2.4 Preamplifier Replacement

If the preamplifier is defective, replace as follows:

1. Unscrew and remove the junction box cover.
2. Disconnect the BNC connector and the four pin connector from the preamplifier.
3. Pull the preamplifier straight out.
4. Plug in a new preamplifier, reconnect the BNC and four pin connector, and replace the junction box cover.

Figure 4-1: Preamplifier Check



4.3 Sensor Tube Replacement

Replacement of a Rosemount 385 Sensor involves the removal and installation of two sets of male connectors, one at the process end of the sensor, and the other at the junction box end. Refer to Section 4.1 for removal of the sensor. Refer to Figure 4-2.

1. The junction box with attached male connector must be recovered from the old sensor for reuse. Unscrew the junction box cover and set aside. Disconnect electrical connections from printed circuit board inside junction box. Disconnect BNC connector to preamp. Unscrew hex nut (D) from male connector body (C). Separate junction box from used sensor. Set aside.

2. Pry off split ferrule from sensor and set aside for reuse. Remove hex nut (D) and set aside for reuse. Check that the internal O-ring is in place in the male connector body (C) attached to the junction box.

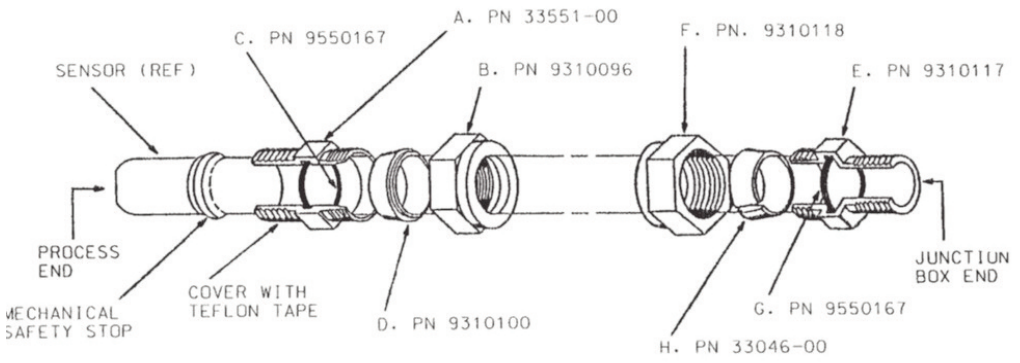
3. Remove hex nut (B) from male connector body (A) at process end of sensor and set aside. Slide the Teflon ferrule and the male connector off sensor in the direction of junction box and set aside. Discard sensor tube.

NOTICE

If stainless steel ferrule was used, male connector body (A) will have to be discarded with the sensor tube. Save male connector if Teflon ferrule was used. Set aside for future use.

4. Discard used O-ring from male connector body (A). Coat new O-ring with a thin film of the O-ring lubricant provided. Position it in the machined Oring groove in place of the discarded O-ring.

Figure 4-2: Sensor Tube Replacement



PROCESS END (A,B,C, & D SOLD TOGETHER AS SST. PROCESS CONNECTOR KIT PN 23166-00 OR TITANIUM PROCESS CONNECTOR KIT PN23166-01)

A. MALE CONNECTOR BODY
B. HEX NUT
C. O-RING
D. TEFLON FERRULE (SST. FERRULE AVAILABLE AS PN 9310094)

JUNCTION BOX END (E, F, G, & H SOLD TOGETHER AS SENSOR HEAD JUNCTION BOX FITTING KIT PN 23472-00)

E. MALE CONNECTOR BODY
F. HEX NUT
G. O-RING
H. SST. SPLIT FERRULE

5. Cover the 1" MNPT pipe threads of the male connector body (A) with Teflon tape (not provided) to protect them from galling during reinstallation.

⚠ CAUTION

Make sure lubricant does not contact any part of the sensor tip particularly the glass bulb.

6. Pass the wires from the new sensor through the process end male connector (A). Make sure that the beveled edge of the ferrule faces the process end of the sensor. Snug the hex nut (B) to keep it n place. Do not tighten down fully on the hex nut at this time.

7. Pass the wires from the new sensor through the hex nut (D), the split ferrule (from the old sensor), male connector body (C), O-ring, and through the junction box from the “neck” opening and out through the space between the printed circuit board and the side of the junction box. Butt the ferrules beveled edge and the sensor tube against the junction male connector (C). Screw the hex nut (D) by hand until the tube is “locked” into the male connector body. Make sure that the male connector body (C) is sufficiently tightened. The sensor will “click” into place by pulling the sensor tube away from the junction box, but will not move from side to side or pull clear of the male connector. If the sensor tube is correctly attached to the junction box, wrench tighten hex nut (D) on male connector body (C). (See Figure 4-3.) Do not put the sensor tube in a vise or use a pipe wrench to tighten the hardware as these will damage the sensor. If sensor tube is not correctly attached to the junction box, loosen hex nut (D) and repeat.

8. Connect the sensor wires to the terminals on the printed circuit board in the junction box in the manner recommended on the junction box cover, or see Figure 2-3. Reattach the BNC connector to the preamp. Screw on the cover of the junction box.

9. Insert the sensor in the process fitting. Stop it against the closed ball valve. Slide the processend male connector down the sensor tube to mate with the process fitting. Tighten the male connector into the process fitting.

10. Pull back hard on the sensor assembly, as if trying to remove the sensor, to be certain that the sensor cannot come free from the valve assembly and male connector. The built-in retraction stop collar at the end of the sensor will butt against the shoulder of the male connector.

11. Open ball valve and position the sensor at the desired insertion depth and orientation. Using a crescent or open end wrench, tighten the hex nut (B) to secure the sensor in place.

NOTICE

A stainless steel ferrule is available if the TEFLON ferrule does not adequately grip. When using the metallic ferrule, be careful and avoid over tightening. This can damage the sensor tube.

⚠ CAUTION

If the male connector leaks during insertion or retraction, replace the O-ring in the male connector body (A).

Note: If the sensor is to be stored, the rubber boot should be filled with 7 pH buffer solution and replaced on sensor tip until ready to use.

4.4 Rosemount 385 ORP

4.4.1 Platinum Electrode Check

The platinum electrode may be checked as follows: There are two types of standard solutions which may be used to check the ORP electrode/transmitter system.

Type 1: One type of commonly used ORP standard solution is the saturated quinhydrone solution. Refer to Section 3.3.

⚠ CAUTION

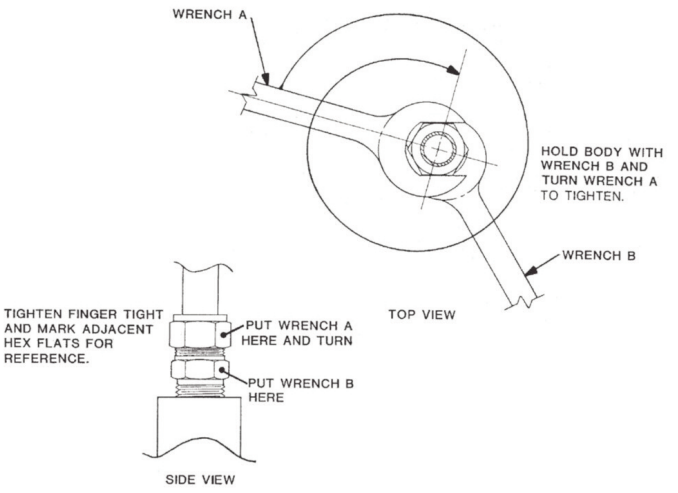
The solution used during the following check is an acid and should be handled with care. Follow the directions of the acid manufacturer. Wear the proper protective equipment. If contact with skin of clothing is made, immediately rinse with plenty of clean water.

Type 2: A second ORP standard solution is the Ferric- Ferrous Ammonium Sulfate Solution (PN R508-16OZ), and it can be ordered as a spare part; otherwise, it can be prepared from the following recipe: Dissolve 39.2 grams or reagent grade ferrous ammonium sulfate, Fe(NH4)2 (SO4)2 • 6H2O and 48.2 grams of reagent grade ferric ammonium sulfate, FeNH4(SO4)2 • 12H2O, in approxi mately 700 milliliters of water (distilled water is preferred, but tap water is acceptable). Slowly and carefully add 56.2 milliliters of concentrated sulfuric acid. Add sufficient water to bring the total solution volume up to 1000 ml. This standard ORP solution, although not as simple to prepare as the quinhydrone recipe, is much more stable, and will maintain its millivolt value for approximately one year when stored in glass containers. This solution (ferric/ferrous ammonium sulfate) will produce a nominal ORP of 476 +20 mV at 25°C when used with a saturated KCl/AgCl reference electrode and platinum measuring electrode. Some tolerance in mV values is to be expected due to the rather large liquid reference junction potentials which can arise when measuring this strongly acidic and concentrated solution. However, if the measuring electrodes are kept clean and in good operating condition, consistently repeatable calibrations can be carried out using this standard solution.

4.4.2 Cleaning Platinum Electrode

If the electrode is never exposed to undesirable compounds, the electrode can be restored to normal operation by simply cleaning the platinum electrode with baking soda. Polish it by rubbing it with a damp paper towel and baking soda until a bright, shiny appearance is attained.

Figure 4-3: Male Connector Tightening Diagram



Section 5: Troubleshooting

5.1 Troubleshooting

Table 5-1: Troubleshooting

Trouble	Probable Cause	Remedy
Meter reads off scale. (Display reads overrange.)	Defective preamplifier.	Check preamplifier as instructed in Section 4.2.3 and replace preamplifier if defective.
	T.C. element shorted.	Check T.C. element as instructed in Section 4.2.2 and replace sensor tube if defective.
	Electrode not in solution or sample. or stream is not full.	Make sure sensor is in solution that sample stream is full (see Section 2.0 for installation)
	Open glass electrode.	Replace sensor tube.
Display reads between 3 and 6 pH regardless of actual pH of solution or sample.	Electrode cracked.	Replace sensor tube.
Meter or display indication swings or jumps widely in AUTO T.C. Mode.	T.C. element shorted.	Check T.C. element as instructed in Section 4.2.2 and replace sensor tube if defective.
Span between buffers extremely short in AUTO T.C. Mode.	T.C. element open.	Check T.C. element as instructed in Section 4.2.2 and replace sensor tube if defective.
Sluggish or slow meter indication for real changes in pH level.	Electrode coated.	Clean sensor as instructed in Sections 4.2.1 or 4.4.2.
	Electrode defective.	Replace sensor tube.
Transmitter cannot be standardized.	Electrode coated or cracked.	Clean sensor as instructed in Sections 4.2.1 or 4.4.2 and, if cracked,replace sensor tube.
	Defective preamplifier.	Check preamplifier as instructed in Section 4.2.3 and replace preamplifier if defective.
Transmitter short spans between two different buffer values.	Old glass electrode (greater than 1 year old).	Replace sensor tube.
	Coated glass.	Clean Sensor as instructed in Sections 4.2.1 or 4.4.2.

Note: For any repair or warranty inquiries please contact our Customer Care group.

Section 6: Accessories

6.1 Accessories

Table 6-1: Accessories for Rosemount 385 sensor

Part Number	Description
23166-00	Connector Kit, 1x1" 316 SS, with O-Ring Groove
23166-01	Connector Kit, 1x1" Titanium, with O-Ring Groove
23240-00	Ball valve Kit, 1-¼" 316 SS (Code 21)
23239-04	Kit, pH Sensor Tube w/3K TC, Titanium, General Purpose (Code 07-10, P/N 23288-08)
23239-05	Kit, pH Sensor Tube w/PT 100 TC, Titanium, General Purpose (Code 08-10, P/N 23288-09)
23239-06	Kit, ORP Sensor Tube w/No TC, Titanium (Code 04-12, P/N 23288-12)
23239-07	Kit, ORP Sensor Tube w/PT 100 TC, Titanium (Code 06-12, P/N 23288-13)
23239-08	Kit, pH Sensor Tube w/3K TC, Titanium, High pH (Code 07-11, P/N 23288-16)
23239-09	Kit, pH Sensor Tube w/PT 100 TC, Titanium, High pH (Code 08-11, P/N 23288-17
33046-00	Ferrule, 1" 316SS, Split (for J-Box)
9200000	Cable, 20#Ga, 4 Cond, 1 Shielded Pair (Belden 8722)
9210012	pH Buffer, 4.01 pH, 16 oz.
9210013	pH Buffer, 6.86 pH, 16 oz.
9210014	pH Buffer, 9.18 pH, 16 oz.
9310096	Hex Nut, 1" 316 SS
9310100	Ferrule, 1" Teflon (Standard)
23594-01	O-ring, 2-214 EPDM (qty 4)

EC Declaration of Conformity

Note: Please see website for most recent Declaration.

EMERSON

EU Declaration of Conformity

(No. 1700911)

CE

pH/ORP Sensors

This declaration is issued under the sole responsibility of the manufacturer:
Rosemount Inc., 8200 Market Blvd., Chanhassen, MN 55317 USA
The sensor models:

328A, 385, 385+ -04, 385+ -02/03, 385+-03-12, 389-01, 389-01-10/11-50, 389-01-10/11-54, 389-01-12-50, 389-01-12-54, 389-01-12-55, 389-02, 389VP, 389VP-70, 396, 396P-01-10/13-50, 396P-01-10/13-54, 396P-01-12-50, 396P-01-12-54, 396P-01-12-55, 396P-01-55, 396VP, 396VP-70, 396R, 396RVP, 396RVP-70, 396P-02, 396PVP, 396PVP-70, 397, 398, 398VP, 398R, 398RVP, 398RVP-70, 3200HP, 3300HT, 3300HT VP, 3300HTVP-70, 3400HT, 3400HT VP, 3400HTVP-70, 3500P-01, 3500P-01-12, 3500P-02, 3500VP-01, 3500VP-01-12, 3500VP-02, 3800, 3800VP, 3900-01, 3900-02, 3900VP-01, 3900VP-02

to which this declaration relates, are in conformity with relevant Union harmonization legislation:
(2014/34/EU) ATEX Directive
Intrinsically Safe, Examination Certificate: Baseefa10ATEX0156X
Provisions of the directive fulfilled by the equipment:
Equipment Group II, Category 1 G Ex ia IIC T4 Ga (-20°C ≤ Ta ≤ +60°C) exceptions noted below

Model 328A Steam sterilizable pH sensor with integral cable
Model 385 Retractable pH/ORP sensor with integral cable
Model 385+ -04 pH/ORP sensor with integral cable
Model 385+ -02/03 pH/ORP sensor with integral cable & Smart preamplifier
Model 385+ -03-12 ORP sensor with integral cable & preamplifier: T4 (-20°C ≤ Ta ≤ +80°C), T5 (-20°C ≤ Ta ≤ +40°C)
Model 389-01 pH sensor with integral cable & Smart preamplifier
Model 389-01-10/11-50 pH sensor with integral cable & preamplifier: T4 (-20°C ≤ Ta ≤ +80°C) or T5 (-20°C ≤ Ta ≤ +40°C)
Model 389-01-10/11-54 pH sensor with integral cable & preamplifier: T4 (-20°C ≤ Ta ≤ +80°C) or T5 (-20°C ≤ Ta ≤ +40°C)
Model 389-01-12-50 ORP sensor with integral cable & preamplifier: T4 (-20°C ≤ Ta ≤ +80°C)
Model 389-01-12-54 ORP sensor with integral cable & preamplifier: T4 (-20°C ≤ Ta ≤ +80°C)
Model 389-01-12-55 ORP sensor with integral cable & preamplifier: T4 (-20°C ≤ Ta ≤ +80°C)
Model 389-02 pH/ORP sensor with integral cable
Model 389VP-70 pH sensor with Variopol connector & Smart preamplifier
Model 389VP pH/ORP sensor with Variopol connector
Model 396 TUpH sensor with integral cable
Model 396P-01-10/13-50 polypropylene pH sensor with integral cable & preamp: T4 (-20°C ≤ Ta ≤ 80°C) or T5 (-20°C ≤ Ta ≤ 40°C)
Model 396P-01-10/13-54 polypropylene pH sensor with integral cable & preamp: T4 (-20°C ≤ Ta ≤ 80°C) or T5 (-20°C ≤ Ta ≤ 40°C)
Model 396P-01-12-50 ORP sensor with integral cable & preamp: T4 (-20°C ≤ Ta ≤ +80°C)
Model 396P-01-12-54 ORP sensor with integral cable & preamp: T4 (-20°C ≤ Ta ≤ +80°C)
Model 396P-01-12-55 ORP sensor with integral cable & preamp: T4 (-20°C ≤ Ta ≤ +80°C)
Model 396P-01-55 pH sensor with integral cable & Smart preamp
Model 396VP TUpH sensor with Variopol connector
Model 396VP-70 TUpH sensor with Variopol connector & Smart preamplifier
Model 396R TUpH Retractable pH/ORPsensor with integral cable
Model 396RVP TUpH Retractable pH/ORP sensor with Variopole connector
Model 396RVP-70 TUpH Retractable pH sensor with Variopole connector & Smart preamplifier
Model 396P-02 TUpH Polypropylene pH/ORP sensor with integral cable
Model 396PVP TUpH Polypropylene pH/ORP sensor with Variopole connector
Model 396PVP-70 TUpH Polypropylene pH sensor with Variopole connector & Smart preamplifier
Model 397 TUpH sensor with integral cable
Model 398 TUpH pH/ORP sensor with integral cable
Model 398VP TUpH pH/ORP sensor with Variopole connector
Model 398R TUpH Retractable pH/ORP sensor with integral cable
Model 398RVP TUpH Retractable pH/ORP sensor with Variopole connector
Model 398RVP-70 TUpH Retractable pH sensor with Variopole connector & Smart preamplifier
Model 3200HP Flowing junction pH sensor with Variopole connector
Model 3300HT Insertion/submersion pH sensor with integral cable
Model 3300HTVP Insertion/submersion pH sensor with Variopole connector
Model 3300HTVP-70 Insertion/submersion pH sensor with Variopole connector & Smart preamplifier
Model 3400HT Retractable pH sensor with integral cable
Model 3400HTVP Retractable pH sensor with Variopole connector
Model 3400HTVP-70 Retractable pH sensor with Variopole connector & Smart preamplifier
Model 3500P-01 High performance pH sensor with integral cable & Smart preamplifier
Model 3500P-01-12 PerpH-X ORP sensor with integral cable & preamplifier: T4 (-20°C ≤ Ta ≤ +80°C)
Model 3500P-02 High performance pH sensor with integral cable
Model 3500VP-01 High performance pH sensor with Variopole connector & Smart preamplifier
Model 3500VP-01-12 PerpH-X ORP sensor with Variopole connector & preamplifier: T4 (-20°C ≤ Ta ≤ +80°C)
Model 3500VP-02 High performance pH sensor with Variopole connector
Model 3800 Steam sterilizable pH sensor with single pole Eurocap connector

Model 3800VP Steam sterilizable pH sensor with Variopole connector
Model 3900-01 pH/ORP sensor with integral cable & Smart preamplifier
Model 3900-02 pH/ORP sensor with integral cable
Model 3900VP-01 pH sensor with Variopole connector & Smart preamplifier
Model 3900VP-02 pH/ORP sensor with Variopole connector

Special conditions for safe use:

1) All pH/ORP sensor models with a plastic enclosure or exposed plastic parts may provide an electrostatic ignition hazard and must only be cleaned with a damp cloth to avoid the danger of ignition due to a build up of electrostatic charge.
2) All pH/ORP sensor models with a metallic enclosure may provide a risk of ignition by impact or friction. Care should be taken during installation to protect the sensor from this risk.
3) External connections to the sensor must be suitably terminated and provide a degree of protection of at least IP20.

All pH/ORP sensor models are intended to be in contact with the process fluid and may not meet the 500V r.m.s test to earth. This must be taken into consideration at installation.

ATEX Notified Body for EC Type Examination Certificate & Quality Assurance:
SGS Baseefa[Notified Body Number:1180], Rockhead Business Park, Staden Lane, Buxton SK17 9RZ UNITED KINGDOM

Assumption of conformity is based on the application of the harmonized standards:
EN 60079-0:2012+A11:2013 Explosive atmospheres. Equipment. General requirements
EN 60079-11:2012 Explosive atmospheres. Equipment protection by intrinsic safety "i"

(Signature)

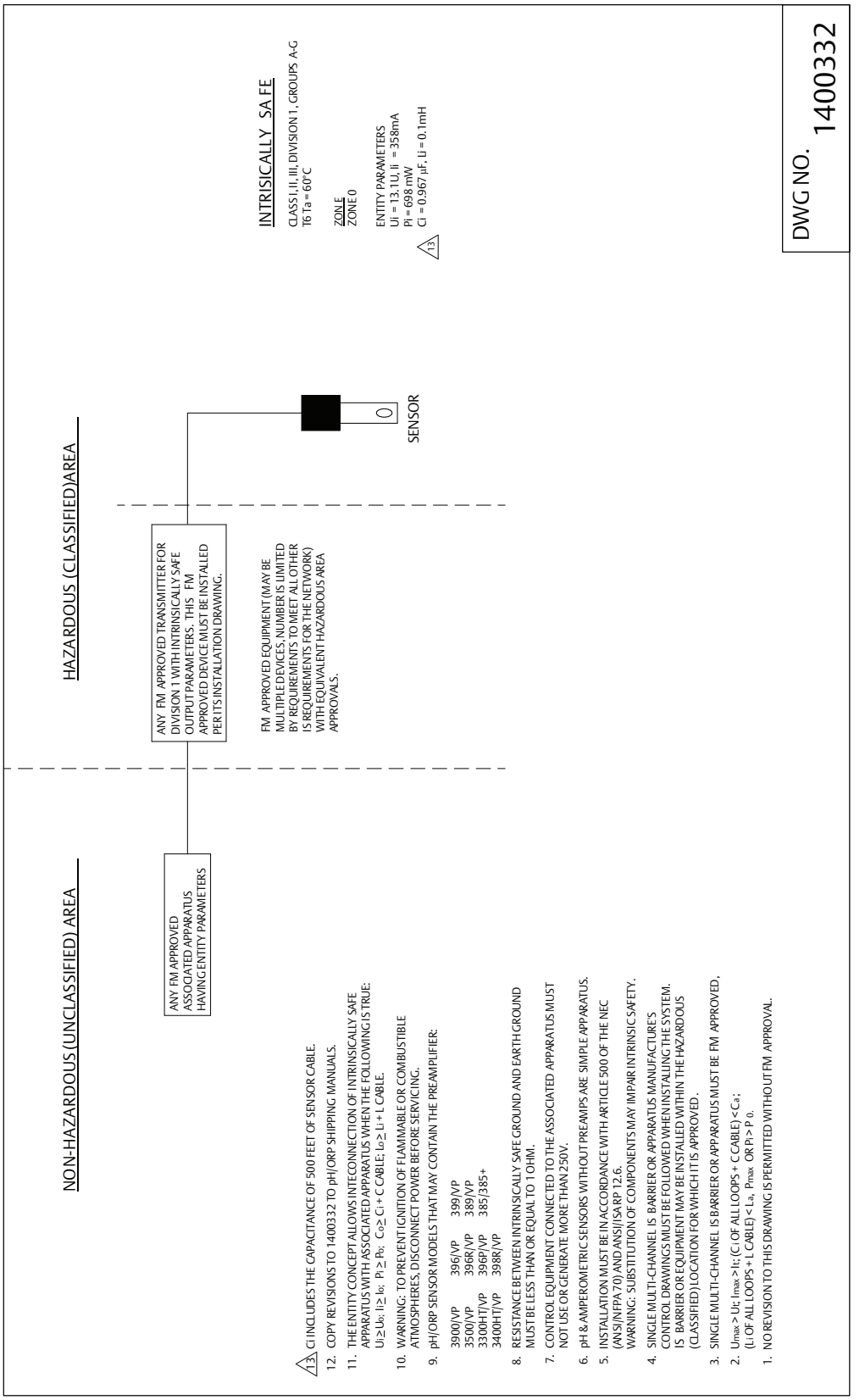
Kim Freeman
(Name printed)

Director of Global Quality
(Function name)

March 23, 2017
(Date of issue)

CE marking was first affixed to this product in 2011

Intrisicallly Safe Sensor Installation Drawing - FM



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Emerson

8200 Market Blvd.
Chanhassen, MN 55317,
USA
Tel +1 800 999 9307
Fax +1 952 949 7001

Liquid.CSC@Emerson.com

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